patient cooperation is needed so that the method can be applied to sick persons. Finally, the method appears sensitive enough to weaken the argument that mismatches are in fact due to the lack of sensitivity of the method used to detect regional ventilatory abnormalities.

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The Use of Bone Scans in Benign Disease of Bone

SIGNIFICANT ADVANCEMENT in nuclear medicine instrumentation and radiopharmaceuticals has resulted in the widespread use of bone scans. A number of excellent publications have stressed the sensitivity and reliability of bone scanning in the detection of occult malignancies. Recent articles also have stressed the value of bone scans in a number of benign conditions.

- *Acute Osteomyelitis.* In patients with bone pain and fever, abnormal findings on bone scan may be the only sign of osteomyelitis. In general, the bone scan in these patients becomes positive within 48 to 72 hours after onset of symptoms.
- *Trauma.* Bone scanning has been shown to be a sensitive indicator of trauma to the skeletal system. Not only are major bone fractures visualized, but small stress fractures that are x-ray negative may be seen.
- *Paget Disease.* The extent of Paget disease can be readily determined from the use of total body bone scans. The response to therapy may also be studied and quantitated using scanning techniques and computers.
- *Benign Tumors.* Benign bone tumors such as osteoid osteomas can be detected using conventional bone scanning techniques.
- *Joint Disease.* Scanning of the arthritides, especially rheumatoid arthritis and osteoarthritis, as well as septic arthritis, is useful in determining the site as well as the extent of involvement.
- *Other Diseases of Bone.* Bone scanning coupled with marrow scanning has proven to be of value in the assessment of bony infarction, Legg-Perthes disease, metabolic disease of bone and other less common diseases of the skeletal system.

In summary, recent advances in radiopharmaceuticals and instrumentation have made possible the evaluation of a number of benign diseases of the skeletal system with a low degree of radiation exposure, and high degree of reliability and safety.

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Soft Tissue Accumulation of Bone Scanning Agents

SCINTIGRAPHY with various technetium-phosphate compounds (TcP) is very useful in the diagnosis of benign and malignant bone disease, and its superior sensitivity compared with radiography is well documented. Like any medical technique, however, it has its shortcomings. These include lack of specificity, occasional false-negative results and also extraosseous radiopharmaceutical localization, which may or may not interfere with interpretation of the study.

While not all causes for soft-tissue uptake are known, a number have been described. They include:

- Physiologic concentration in the urinary tract, since TcP is excreted by this route. This permits, from time to time, detection of unsuspected genitourinary pathology.
- Poor quality of the radiopharmaceutical, leading to concentration of free technetium in thyroid and stomach or to colloid aggregation and phagocytic uptake in liver and spleen.
- Increased tissue calcium levels, as in necrotic and acutely damaged muscle and in some calcifying neoplasms and granulomas (sarcoid). The high TcP concentration in acutely infarcted myocardium has been turned to advantage for detection and localization of acute myocardial infarcts. Even slight skeletal muscle damage, due to repeated intramuscular injections, may result in prominent TcP deposition.
- For reasons still unknown, normal breast tissue and a number of soft tissue tumors without demonstrated abnormalities in calcium metabolism will also concentrate TcP, particularly carcinoma of the lung, breast and colon and sarcoma.

Unusual extraosseous TcP concentration (outside of the genitourinary tract) is seen in about 10 percent of all bone scans. To avoid confusion and unnecessary repetition of procedures, nuclear medicine specialists and referring physicians have to be aware of its occurrence and causes.

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Radionuclide Studies in Peripheral Arterial Disease

TWO RECENT important clinical applications of radionuclide studies in the evaluation of peripheral arterial disease have been described. The first, described by Siegel, involves the use of intraarterially injected ^{99m}Tc human serum albumin microspheres as means of visualizing and quantifying the inherent hyperemic response which would be necessary for an "ischemic ulcer" to heal. The procedure is analogous to a lung scan in that the distribution of the microspheres is proportional to the distribution of perfusion. If, after point counting over the ulcer and the surrounding tissue, the relative hyperemia of the ulcer to the surrounding tissue is equal to or greater than 3.5:1, then there is a 90 percent probability that the ischemic ulcer will heal with conservative measures. However, if this degree of hyperemia is not present, there is about a 90 percent probability that healing will not occur and an amputation will eventually be required. It is anticipated that the procedure will prevent an unnecessarily prolonged stay in hospital and premature surgical procedures.

The second application is the use of isotopically derived skin perfusion pressures as a prognostic indication of postamputation skin flap healing. Lassen, using intradermally injected tracer amounts of a ^{131}I-antipyrine-histamine mixture, has developed a simple method to determine local skin perfusion pressure. An external pressure system is applied with force just sufficient to stop tracer washout from the region. This pressure is recorded as the skin perfusion pressure.

It has been noted that all skin flaps with pressures below 20 mm of mercury fail to heal, while none of those with pressures greater than 40 mm of mercury fail to heal because of ischemic necrosis. The region between 20 to 40 mm of mercury is considered an undeterminant zone. As in the first procedure described it is anticipated that the approach will help avoid premature reamputation or unnecessarily prolonged stays in hospital.

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